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SEED PRODUCTION FROM SUGAR BEETS OVER-WINTERED IN THE FIELD

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In Cooperation With the New Mexico College of Agriculture and Mechanic Arts

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INTRODUCTION

For a number of years the New Mexico Agricultural Experiment Station in cooperation with the Office of Sugar Plants, Bureau of Plant Industry, United States Department of Agriculture, has been investigating certain phases of sugar-beet culture in the Rio Grande Valley of southern New Mexico. The attempts to grow sugar beets following standard methods were not successful, and it is apparent that there is little hope of successful sugar-beet culture in this region until some way is discovered of combating curly top, a virus disease of sugar beets. This disease has occurred in practically a 100 per cent infestation every year and has reduced the tonnage far below a profitable figure. The results obtained year after year were consistent. Beets were planted in February or March, and good stands were obtained. The beets grew thriftily until late spring or early summer, when curly top made its appearance, and within a few weeks the field presented a hopeless prospect. Various varieties were tested and various soil types used, but curly top was so severe that yields were never worth recording.

TESTS IN PLANTING FOR SEED PRODUCTION

TESTS OF 1922–23

In 1922 the tests included plantings at various dates in order to determine the results obtainable from fall plantings. Plant-

[1] Credit is due W. W. Tracy, associate agronomist in the Office of Sugar Plants, Bureau of Plant Industry, for valuable suggestions and assistance in connection with the experiments herein reported.

ings were made on the 1st and 15th of each month beginning September 1, 1922, and were continued through the winter and spring until July 15, 1923. There was no difficulty in getting a strong stand from the September and October plantings, but a rather high percentage of the November, December, and January plantings failed to survive the cold weather which followed. The fall plantings produced beets of from 1 inch to 2 inches in diameter before cold weather stopped vegetative growth, and it was found that the subsequent winter weather did not injure the plants to any noticeable extent.

With the opening of the warm spring weather approximately 95 per cent of the plants sown in September and October produced seed stalks. Approximately 50 per cent of the plants surviving in the November and December plantings produced seed stalks. As is

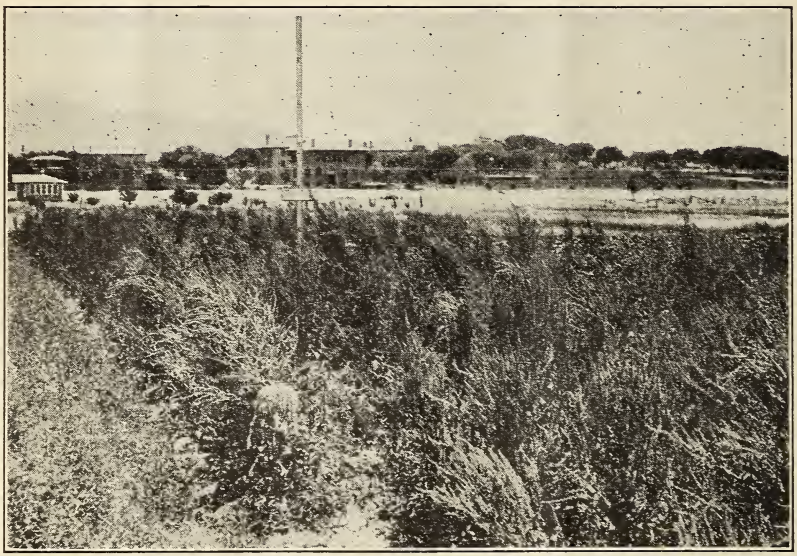

FIG. 1.—Sugar beets gone to seed in southern New Mexico, June 11, 1923. Planted September, 1922

shown in Figure 1, the yield of seed was heavy. Definite seed yields were not taken.

TESTS OF 1923–24

The test plantings[2] were repeated in the fall of 1923, with results similar to those of the preceding year. Unfortunately, the sugar-beet plants were very severely damaged by jack rabbits so that many potential seed-producing plants were destroyed. Such plants as were not injured set seed heavily, and there doubtless would have been a heavy yield of seed had the field been adequately fenced. No seed yields were recorded in 1924, the results of this year merely confirming the results of the preceding season.

[2] The plantings were made in plots of four rows each, and these were divided into four equal subplots of four rows, each having an area of 363 square feet, or 0.00833 acre. The rows were spaced 22 inches apart. In the fall the beets were thinned to approximately a 12-inch spacing.

TESTS OF 1924–25

In the fall of 1924 the tests of the previous years were repeated, and results were entirely consistent with those observed in the two preceding seasons. The September and October plantings produced good strong plants, an inch or two in diameter; but the October or later plantings, for the most part, did not produce plants of sufficient size to survive the winter. From the fall plantings a high percentage of seed-producing plants was obtained, and the set of seed was good. The field available for the experiment was not uniform in soil type, and the yields of seed obtained varied considerably. The seed was harvested and threshed with a small experimental thresher and was recleaned with an ordinary fanning mill. No draper [3] was available, so the figures given are from 10 to 15 per cent higher than they would be if the seed had been thoroughly cleaned.

FIG. 2.—Sugar-beet seed crop in southern New Mexico in 1926. Planted August, 1925

The maximum yield of seed obtained from any one plot corresponded to a yield of 1,613 pounds to the acre, but one plot yielded as low as 214 pounds. The average yield of all plots was 752 pounds of undrapered [4] seed to the acre. While this figure may be rather low, the results in 1925 did indicate that, given the proper soil, proper time of planting, and a fair stand of strong plants, an excellent yield was obtainable.

TESTS OF 1925–26

In 1925 the plantings were begun August 1 instead of September 1, and plantings were made on the 1st and 15th of each month up to November 15. The seed was Pioneer, obtained from the American

[3] A special machine for cleaning sugar-beet seed.

[4] See footnote 3.

Beet Sugar Co. of Rocky Ford, Colo. The November plantings were seriously damaged during the winter and were plowed up. The August and September plantings did exceptionally well. Seed from all plots was thoroughly cleaned after threshing, and the yields as given represent merchantable seed. The results are shown in Table 1.

TABLE 1.—*Sugar-beet seed produced in experiments at State College, N. Mex., in 1926: Various dates of planting and various spacings compared*

[Although the computed yield per acre as given fails (in almost every instance) by several units to check with the figures obtained by computing the yield from the area and yield here given, the differences are not greater than may be accounted for by assuming that the decimal fractions for area and actual yield have been raised or last figures dropped]

Date of planting	Spacing in row	Area of plot [a]	Actual yield of clean seed [b]	Computed yield per acre of clean seed	Average
1925	*Inches*	*Acre*	*Pounds*	*Pounds*	*Pounds*
Aug. 1	12	0.0105	22.75	2,163	2,044
Do	12	.0105	20.25	1,925	
Do	24	.0105	13.75	1,307	1,533
Do	24	.0105	18.50	1,759	
Aug. 15	12	.0105	15.50	1,474	1,843
Do	12	.0105	23.25	2,211	
Do	24	.0105	10.13	963	1,260
Do	24	.0105	16.38	1,557	
Sept. 1	12	0.0105	5.13	488	
Do	12	.0105	15.50	1,474	1,028
Do	12	.0105	4.25	404	
Do	12	.0105	18.38	1,748	
Sept. 15	12	.0105	3.63	345	
Do	12	.0105	8.00	760	
Do	12	.0105	6.63	630	
Do	12	.0105	11.75	1,117	
Do	12	.0184	21.13	1,149	
Do	12	.0184	26.63	1,447	
Do	12	.0053	9.63	1,831	
Do	12	.0053	10.88	2,069	[c] 1,580±
Do	12	.0105	30.13	2,864	505
Do	12	.0105	33.13	3,150	
Do	12	.0105	22.38	2,129	
Do	12	.0105	24.00	2,282	
Do	12	.0105	16.88	1,605	
Do	12	.0105	13.75	1,307	
Do	12	.0105	12.38	1,177	
Do	12	.0105	15.00	1,426	
Do	[d] 12	.0158	15.50	982	1,267
Do	[d] 12	.0158	24.50	1,552	

[a] The usual size of plot represented four 22-inch rows, or an area of 0.0105 acre. A few variations from this figure will be noted.

[b] Seed was harvested July 1, 1926, by cutting and shocking immediately.

[c] Probable error determined by formula: P. E. $=0.6745 X \frac{\sqrt{\Sigma d^2}}{N}$.

[d] Rows 44 inches apart.

The data for 1926 indicate that the August plantings (fig. 2) yielded more heavily than the other plantings, but the very high individual plot yields obtained from September 15 plantings (fig. 3) indicate that high yields are obtainable over a considerable period. Although September 15 plantings averaged higher than September 1 plantings, the observations of other years warrant the opinion that plantings prior to September 15 are preferable.

Twelve-inch spacing in 22-inch rows yielded higher than 24-inch spacing, but the present data are too meager to permit a statement of the best practice in this regard. Where alternate rows were cut

out, as was done in some of the plots planted September 15, the yields were decreased.

TESTS OF 1926–27

In 1926 plantings were made at 15-day intervals beginning September 1 and continuing until November 1, and a considerable area was planted on September 15 for a spacing experiment. The crop was harvested from June 20 to July 1, 1927. The quantity of seed planted was 18 pounds to the acre except in one series of plots left unthinned, in which 9 pounds to the acre were used. The data of the planting experiment were not so good as those of the spacing experiment, owing to differences in the field, but the data, as shown in Table 2, very decidedly favored September plantings. Only one

FIG. 3.—Sugar-beet seed crop in southern New Mexico in 1926. Planted September, 1925

plot of the November 1 planting was worth harvesting. The data for the spacing experiment, as shown in Table 2, indicate that higher yields of seed can be obtained where no thinning at all is done.

Although no previous data on this method of planting had been obtained, the indications in the past have been that the heaviest yields were obtained where the plants grew thickest. Spacing single plants 24 inches apart was just a little better than 12-inch spacings, but blocking 12 inches apart was considerably better than single plants. No particular advantage was indicated by making the rows 44 inches apart, except that possibly such beets can be cultivated with the regular cotton or corn cultivator and no special implements are required. The yield was approximately one-third less than the highest yield obtained from leaving the beets unthinned.

TABLE 2.—*Sugar-beet seed produced in experiments at State College, N. Mex., in 1927: Various dates of planting and various spacings compared* [1]

[Size of plots, 0.0104 acre; rows 22 inches apart except as otherwise stated]

Date of planting	Number of plots	Spacing in row	Average acre yield of cleaned seed	Remarks
1926		*Inches*	*Pounds*	
Sept. 1	9	12	904±169	
Sept. 15	19	12	918±353	
Oct. 1	8	12	481±172	
Oct. 15	5	12	550±123	
Nov. 1	1	12	351	
Sept. 15	30	[2] 12	1,394±315	
Do	9	12	1,548±385	
Do	9	([3])	1,831±307	18 pounds of seed planted per acre.
Do	9	([3])	1,711±192	9 pounds of seed planted per acre.
Do	9	24	1,405±331	
Do	18	12	1,284±415	Rows 44 inches apart.

[1] The viability of the seed produced in 1927 was not satisfactory, presumably owing to climatic conditions at the time the seed was setting. In commercial practice elsewhere in the West, this condition has been met by proper timing of the irrigations during the pollination period.
[2] Blocked 12 inches apart and not thinned to a single plant.
[3] Unthinned.

SUMMARY AND CONCLUSIONS

This circular discusses briefly the experiences with growing sugar-beet seed over a number of years. It presents the rather paradoxical situation of suggesting sugar-beet seed production under New Mexico conditions, in spite of the fact that all attempts to raise sugar beets as a commercial crop have failed.

As has been stated, this failure of sugar beets in New Mexico has come about almost entirely because of curly top, a virus disease of sugar beets, which has caused enormous damage in the Western States. This disease does not arise from a seed source but is brought to the growing fields by the so-called white fly or leaf hopper, *Eutettix tenellus*, whose native host plants are desert plants which harbor the virus. There seems to be no possibility of commercial beet growing in areas such as the Rio Grande Valley until resistant or disease-tolerant varieties are developed, and these do not as yet exist.

In the experiments outlined, the curly-top disease was largely if not almost entirely avoided by late summer and fall plantings.[5] Repeated examinations of the fall-grown plants showed them to be practically free from curly-top symptoms, and no interference with seed-stalk production which could be assigned to curly top was noted except in the plantings of 1926.

The observations here reported have extended over five seasons, and it is believed that in each of these years a profitable seed crop could have been obtained from beet seed planted at the proper time and given proper care.

The production of seed under the conditions outlined, if it should continue to give such results as have so far been obtained, would present certain distinct advantages. The method is simply a method

[5] In the fall of 1926 the experimental planting showed the highest percentage of curly top found in this series of tests. Some rows showed 25 per cent of the plants affected. Undoubtedly this played an important rôle in reducing seed yields of susceptible strains this season.

of steckling production without the expense of harvesting, storing, and resetting the stecklings.[6] Advantage is taken of the comparatively mild winters of the southern New Mexico region and the plants are wintered in the field.

In the experiments outlined, the standard methods used for growing sugar beets have been followed. Further work is necessary to determine the best methods for seed production.

The fact that increase of seed stocks can be started the same year and seed obtained in time for preliminary tests the next season directs attention to the possible importance of such areas as southern New Mexico in connection with sugar-beet breeding investigations.

The possibility of growing seed by the method developed during the course of the studies here reported may be significant not only from the standpoint of cost reduction but also because it will afford a practical means for quantity production in the United States of seed of desirable strains that may be obtained as the result of breeding for disease resistance or other local adaptations important in the sugar-beet areas of America.

The experiments carried on have not been on any such scale as to permit estimates of cost of seed production, but it is obvious that with anything like a comparable seed yield to that obtained in other districts the cost in New Mexico will be low. Experience so far indicates that the loss of plants in the field is far below the loss which occurs often in siloed stecklings or mother beets.

The experimental work is being continued. This progress report is issued in order that sugar-beet companies may follow the work and be informed of the possible commercial advantages.

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[6] Adopted from the German. Small late-planted sugar beets which are harvested in the fall and stored over winter in soils, to be transplanted to the field the following spring for seed-stalk production.

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